

CLAIMS

- 1 1. A workpiece chuck for supporting a workpiece, comprising:
2 a top layer on which the workpiece can be mounted; and
3 a temperature control assembly in thermal communication with the top layer
4 to control temperature in the workpiece, the temperature control assembly
5 comprising:
6 an upper layer,
7 a lower layer, and
8 at least one thermoelectric module disposed between the upper layer
9 and the lower layer of the temperature control assembly, wherein the at least
10 one thermoelectric module is segmented into a plurality of segments.
- 1 2. The workpiece chuck of claim 1, wherein the segments are electrically connected
2 together.
- 1 3. The workpiece chuck of claim 1, wherein the segments are electrically connected
2 together in series.
- 1 4. The workpiece chuck of claim 1, wherein the at least one thermoelectric module
2 comprises a top surface and a bottom surface, at least one of the top and bottom
3 surfaces being segmented.
- 1 5. The workpiece chuck of claim 4, wherein the segments are electrically connected
2 together by a conductor on at least one of the top and bottom surfaces.
- 1 6. The workpiece chuck of claim 4, wherein the segments are electrically connected
2 together in series by a conductor on at least one of the top and bottom surfaces.

- 1 7. The workpiece chuck of claim 1, further comprising at least one spacer between the
2 upper layer and the lower layer of the temperature control assembly, the at least one
3 spacer vertically spacing the upper layer and the lower layer of the temperature
4 control assembly such that the at least one thermoelectric module vertically floats in
5 a space between the upper layer and the lower layer of the temperature control
6 assembly.
- 1 8. The workpiece chuck of claim 7, further comprising a thermally conductive
2 medium in the space for thermally coupling the at least one thermoelectric module
3 to the upper layer and the lower layer of the temperature control assembly.
- 1 9. The workpiece chuck of claim 8, wherein the thermally conductive medium
2 comprises a thermal grease.
- 1 10. The workpiece chuck of claim 1, wherein the at least one thermoelectric module
2 comprises a Peltier device.
- 1 11. The workpiece chuck of claim 2, wherein the upper layer and the lower layer of the
2 temperature control assembly are fastened together by a plurality of screws.
- 1 12. The workpiece chuck of claim 11, wherein the at least one spacer comprises a
2 clearance hole through which one of the screws passes.
- 1 13. The workpiece chuck of claim 11, wherein the at least one spacer comprises a
2 plurality of arms extending radially between the center and edges of the temperature
3 control assembly.

- 1 14. The workpiece chuck of claim 1, wherein the workpiece is a semiconductor wafer.
- 1 15. A workpiece chuck for supporting a workpiece, comprising:
2 a top layer on which the workpiece can be mounted; and
3 a temperature control assembly in thermal communication with the top layer
4 to control temperature in the workpiece, the temperature control assembly
5 comprising:
6 an upper layer,
7 a lower layer, and
8 at least one thermoelectric module disposed between the upper layer
9 and the lower layer of the temperature control assembly, wherein the at least
10 one thermoelectric module comprises a plurality of thermoelectric
11 submodules.
- 1 16. The workpiece chuck of claim 15, wherein the submodules are electrically
2 connected together.
- 1 17. The workpiece chuck of claim 15, wherein the submodules are electrically
2 connected together in series.
- 1 18. The workpiece chuck of claim 15, wherein each of the submodules comprises a top
2 surface and a bottom surface.
- 1 19. The workpiece chuck of claim 18, wherein the submodules are electrically
2 connected together by a conductor on at least one of the top and bottom surfaces.
- 1 20. The workpiece chuck of claim 18, wherein the submodules are electrically
2 connected together in series by a conductor on at least one of the top and bottom

3 surfaces.

1 21. The workpiece chuck of claim 15, further comprising at least one spacer between
2 the upper layer and the lower layer of the temperature control assembly, the at least
3 one spacer vertically spacing the upper layer and the lower layer of the temperature
4 control assembly such that the at least one thermoelectric module vertically floats in
5 a space between the upper layer and the lower layer of the temperature control
6 assembly.

1 22. The workpiece chuck of claim 21, further comprising a thermally conductive
2 medium in the space for thermally coupling the at least one thermoelectric module
3 to the upper layer and the lower layer of the temperature control assembly.

1 23. The workpiece chuck of claim 22, wherein the thermally conductive medium
2 comprises a thermal grease.

1 24. The workpiece chuck of claim 15, wherein the at least one thermoelectric module
2 comprises a Peltier device.

1 25. The workpiece chuck of claim 21, wherein the upper layer and the lower layer of
2 the temperature control assembly are fastened together by a plurality of screws.

1 26. The workpiece chuck of claim 25, wherein the at least one spacer comprises a
2 clearance hole through which one of the screws passes.

1 27. The workpiece chuck of claim 25, wherein the at least one spacer comprises a
2 plurality of arms extending radially between the center and edges of the temperature
3 control assembly.

- 1 28. The workpiece chuck of claim 15, wherein the workpiece is a semiconductor wafer.
- 1 29. A method of supporting a workpiece with a workpiece chuck, comprising:
2 providing a top layer of the workpiece chuck on which the workpiece can be
3 mounted; and
4 providing a temperature control assembly in thermal communication with
5 the top layer to control temperature in the workpiece, the temperature control
6 assembly comprising:
7 an upper layer,
8 a lower layer,
9 at least one thermoelectric module disposed between the upper layer
10 and the lower layer of the temperature control assembly, wherein the at least
11 one thermoelectric module is segmented into a plurality of segments.
- 1 30. The method of claim 29, wherein the segments are electrically connected together.
- 1 31. The method of claim 29, wherein the segments are electrically connected together
2 in series.
- 1 32. The method of claim 29, wherein the at least one thermoelectric module comprises
2 a top surface and a bottom surface, at least one of the top and bottom surfaces being
3 segmented.
- 1 33. The method of claim 32, wherein the segments are electrically connected together
2 by a conductor on at least one of the top and bottom surfaces.
- 1 34. The method of claim 32, wherein the segments are electrically connected together

in series by a conductor on at least one of the top and bottom surfaces.

35. The method of claim 29, wherein the temperature control assembly further comprises at least one spacer between the upper layer and the lower layer of the temperature control assembly, the at least one spacer vertically spacing the upper layer and the lower layer of the temperature control assembly such that the at least one thermoelectric module vertically floats in a space between the upper layer and the lower layer of the temperature control assembly.

36. The method of claim 35, further comprising providing a thermally conductive medium in the space for thermally coupling the at least one thermoelectric module to the upper layer and the lower layer of the temperature control assembly.

37. The method of claim 29, wherein the workpiece is a semiconductor wafer.

38. A method of supporting a workpiece with a workpiece chuck, comprising:
providing a top layer of the workpiece chuck on which the workpiece can be mounted; and
providing a temperature control assembly in thermal communication with the top layer to control temperature in the workpiece, the temperature control assembly comprising:
an upper layer,
a lower layer,
at least one thermoelectric module disposed between the upper layer and the lower layer of the temperature control assembly, wherein the at least one thermoelectric module comprises a plurality of thermoelectric submodules.

- 1 39. The method of claim 38, wherein the submodules are electrically connected
2 together.
- 1 40. The method of claim 38, wherein the submodules are electrically connected
2 together in series.
- 1 41. The method of claim 38, wherein each of the submodules comprises a top surface
2 and a bottom surface.
- 1 42. The method of claim 41, wherein the submodules are electrically connected
2 together by a conductor on at least one of the top and bottom surfaces.
- 1 43. The method of claim 41, wherein the submodules are electrically connected
2 together in series by a conductor on at least one of the top and bottom surfaces.
- 1 44. The method of claim 38, wherein the temperature control assembly further
2 comprises at least one spacer between the upper layer and the lower layer of the
3 temperature control assembly, the at least one spacer vertically spacing the upper
4 layer and the lower layer of the temperature control assembly such that the at least
5 one thermoelectric module vertically floats in a space between the upper layer and
6 the lower layer of the temperature control assembly.
- 1 45. The method of claim 44, further comprising providing a thermally conductive
2 medium in the space for thermally coupling the at least one thermoelectric module
3 to the upper layer and the lower layer of the temperature control assembly.
- 1 46. The method of claim 38, wherein the workpiece is a semiconductor wafer.